

1 **I/WE CLAIM:**

2 1. A method of engine starting in a gas turbine engine  
3 comprising:

4 rotating the engine to provide an air flow into a  
5 combustor of the engine;

6 injecting fuel into the combustor at a varying rate  
7 until the engine is lighted-off, the varying rate  
8 being a function of time and represented by a curve  
9 having at least one high frequency with respect to a  
10 light-off time, representing instant changes of the  
11 rate for intersecting a light-off zone while  
12 reducing a quantity of fuel injected into the  
13 combustor; and then,

14 continuously injecting fuel into the combustor to  
15 accelerate the engine to a self-sustaining operation  
16 condition.

17 2. A method as claimed in claim 1 wherein the curve  
18 comprises a low frequency with respect to the light-off  
19 time, representing a change trend of the varying rate.

20 3. A method as claimed in claim 2 wherein the curve has an  
21 increasing trend and comprises an oscillatory profile.

22 4. A method as claimed in claim 2 wherein the curve has an  
23 increasing trend and comprises a series of spikes.

- 1 5. A method as claimed in claim 2 wherein the curve has an  
2 increasing trend and comprises a squared-off wave  
3 profile.
- 4 6. A method as claimed in claim 2 wherein the curve has an  
5 increasing trend and comprises a step profile.
- 6 7. A method as claimed in claim 2 wherein the engine is  
7 rotated at a varying speed as a function of time.
- 8 8. A method as claimed in claim 6 wherein the engine is  
9 rotated at an increasing speed.
- 10 9. A method as claimed in claim 2 further comprising  
11 introduction of a predetermined first fuel flow level  
12 into the combustor prior to fuel injection at the  
13 varying rate.
- 14 10. A method as claimed in claim 9 further comprising:  
15 selecting a minimum engine speed to begin the  
16 introduction of the predetermined first fuel flow level  
17 for stating the engine under a variety of altitude and  
18 temperature conditions.
- 19 11. A method as claimed in claim 10 further comprising:  
20 sensing a temperature of the fuel to be injected into  
21 the combustor;  
22 sensing a temperature of the air flow to be provided  
23 into the combustor;  
24 sensing a forward flight velocity ram quantity;

1       sensing an ambient air pressure;  
2       sensing the varying speed of the engine; and  
3       processing the sensed data to determine the minimum  
4       engine speed for the introduction of the  
5       predetermined first fuel flow level.

6 12. A method as claimed in claim 2 further comprising:  
7       sensing a temperature of an exhaust gas flow to  
8       determine if the light-off occurs.

9 13. A method as claimed in claim 2 further comprising:  
10       biasing a profile of the curve representing the varying  
11       fuel injection rate according to changes in the altitude  
12       and temperature conditions.

13 14. A method as claimed in claim 2 further comprising:  
14       changing the predetermined first fuel flow level  
15       according to changes in the altitude and temperature  
16       conditions.

17 15. A method as claimed in claim 11 further comprising:  
18       measuring a light-off time taken from the beginning of  
19       the introduction of the predetermined first fuel  
20       flow level, to the occurrence of the light-off; and  
21       storing the measured light-off time and the sensed data  
22       in a database for reference in a future engine  
23       starting process when a search shows no data  
24       associated with an altitude and temperature  
25       condition, similar to a current altitude and

1 temperature condition generated in a previous  
2 light-off process and stored in the database.

3 16. A method as claimed in claim 15 further comprising:

4 changing a criterion of the minimum engine speed and the  
5 predetermined first fuel flow level to reduce the  
6 light-off time according to the stored data  
7 associated with the similar altitude and temperature  
8 condition, when such data is located in the  
9 database; and

10 storing data regarding the changes and the light-off  
11 time currently measured, and deleting the previously  
12 stored data of the minimum engine speed and the  
13 predetermined first fuel flow level and the  
14 previously stored light-off time associated with the  
15 similar altitude and temperature condition, when the  
16 current light-off time is shorter than the  
17 previously stored light-off time.

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